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Note: a complete list of IADN publications can be found on the IADN web site:

http://www.msc-smc.ec.gc.ca/iadn/resources/publications_e.html

under the Resources tab.

APPENDIX A - GLOSSARY

IADN QAPP GLOSSARY

Accuracy - the closeness of agreement between an observed value and an accepted value. Accuracy includes a combination of random and systematic error or bias components.

Arithmetic Mean - the most commonly used measure of central tendency, commonly called the "average." Mathematically, it is the sum of all the values of a set divided by the number of values in the set.

Bias - a constant or systematic error frequently present in test work. It differs from random error and manifests itself as a persistent positive or negative deviation from the known or true value.

Blank - an artificial or clean "sample" designed to monitor the introduction of artifacts into the measurement process. The blank is taken through all appropriate steps of the process.

Blind Sample - a sample submitted for analysis whose composition is known to the submitter but unknown to the analyst. A blind sample is one way to test proficiency of a measurement process.

Calibration Standards - a gaseous or liquid mixture prepared from the primary dilution standard and stock standards of the internal reference and surrogate analytes. The mixtures are used to calibrate the instrument and record the detection of the analyte concentration.

Calibration - a comparison of a measurement standard or instrument with another standard or instrument to report or eliminate by adjustment any variation (deviation) in the accuracy of the item being compared. The concentration levels of the calibration standards should bracket the range of concentrations for which actual quantifiable test results are expected.

Chain-of-Custody - a procedure for preserving the integrity of a sample or of data. (e.g., a written record listing the location of the sample/data at all times).

Coefficient of Variation - a measure of relative dispersion (precision). It is equal to the standard deviation divided by the mean, multiplied by 100, and expressed as a percentage value.

Collocated Samples - independent samples collected in such a manner that they are equally representative of the parameters of interest at a given point in space and time.

Comparability - a measure of the confidence with which one data set can be compared to another.

Completeness - the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal operations, usually expressed as a percentage.

Confidence Level - the chance or probability, usually expressed as a percentage, that a confidence interval will include a specific population parameter. The confidence levels usually associated with confidence intervals are 90, 95, and 99 percent.

Congener - A chemical substance that is related to another substance, such as a derivative of a compound or an element belonging to the same family as another element in the periodic table.

Correlation Coefficient - a number between -1 and +1 that indicates the degree of linearity between two sets of numbers. The closer to -1 or +1, the stronger the linear relationship between the sets (i.e., the better the correlation). Values close to zero suggest no correlation between the sets (i.e., independence is indicated).

CV - see "Coefficient of Variation."

Data Quality - the totality of features and characteristics of data that bears on its ability to satisfy a given purpose. The characteristics of major importance are accuracy, precision, completeness, representativeness, and comparability.

Data Quality Indicator (DQI) - Statements of data quality commonly used to express measurement uncertainty as precision, accuracy, representativeness, completeness and comparability. DQIs may or may not correspond to DQOs.

Data Reduction - the process of transforming raw data by the use of calculations, standard curves, concentration factors, etc., and collating them into a form more easily used by the data user.

Data Validation - a systematic process for reviewing a body of data against a set of criteria to provide assurance that the data are adequate for their intended use.

Degrees of Freedom - the divisor used in the calculation of a variance term; in the simplest cases it is one less than the number of results.

Detection Limit - the smallest concentration/amount of the component or analyte of interest that can be measured by a single measurement with a stated level of confidence.

Duplicate Measurement - a second measurement made on the same (or identical) sample of material to assist in the evaluation of measurement variance.

Duplicate Sample - a sample that has been divided (in the field, in the preparation lab, or prior to analysis) with both aliquots carried through all steps of processing in an identical manner. (See "replicate sample" and "split sample.")

Equipment Blanks - clean "samples" which are opened in the field and the contents brought into contact with the sample collection device, collected in a sample container, and returned to the laboratory as a sample. Equipment blanks are used to check on sampling device cleanliness. (See also "field blank.")

Field Blank - a clean "sample" that has not been exposed to the sample stream but has been carried to the sampling site and exposed to sampling conditions (bottle caps removed, preservatives added), sample preparation (reagents), and the measurement system. (See also "equipment blank.")

Geometric Mean - measure of the most representative location parameter for a log-normal distribution of data. Mathematically calculated as the nth root of the product of n values, or by transforming the data to the logarithm, calculating the average of the transformed data, and then taking the antilog.

Geometric Standard Deviation - measure of the dispersion for a log-normal distribution of data. Mathematically calculated as the antilog of the standard deviation of the logarithms of the measurements.

Isomer - One of two or more chemical substances having the same elementary percentage composition and molecular weight but differing in molecular structure, and therefore in properties; there are many ways in which such structural differences occur; one example is provided by the compounds isobutane, $CH_3CH(CH_3)_2$, and *n*-butane, $CH_3(CH_2)_2CH_3$.

Instrument Detection Limit (IDL) - The minimum level or concentration of the analyte which can be observed by the instrument and which is statistically different from the response obtained from background instrumental noise. For an IADN official definition of IDL, see Section 3.3.1 of Appendix I.

Laboratory Blank (LB) - A blank sample used as a baseline for the point of comparison. For example, a blank is processed and prepared for analyses along with field samples, and used to adjust or correct routine analytical results.

Laboratory Matrix Blank (LMB) - A clean, unused sampling matrix (filter, XAD resin, etc.) which is processed through the preparation and analytical method to establish baseline concentrations in the sampling media and identify any artifacts.

Laboratory Matrix Sample (LMS) - A combined spike of known quantities of multiple analytes which is added to a blank sampling matrix (filter, XAD resin, etc.) and processed through the preparation and analytical method. Laboratory matrix samples are processed periodically to provide recovery data for assessment of laboratory accuracy and precision.

Laboratory Surrogate Spike (LSS) - A known quantity of a compound or target analyte which is added to the sample being analyzed to provide recovery data for assessing laboratory accuracy and precision.

Limit of Detection (LOD) - The minimum level or concentration of the analyte which can be observed by the instrument and distinguished from instrument noise with a specified degree of probability, calculated from field blanks. For an IADN official definition of LOD, see Section 3.3.3 of Appendix I.

Method Detection Limit (MDL) - The lowest concentration of analyte in distilled water or applicable solvent that a method can detect reliably and that is statistically different from a blank carried through the complete method, including extraction and pretreatment of the sample. For an IADN official definition of MDL, see Section 3.3.2 of Appendix I.

Minimum Detectable Level - see "method detection limit."

Noise - the random errors of observation and other uncontrollable effects which are irrelevant to the purpose of the measurements.

Outlier - a value which appears to deviate markedly from other members of the sample in which it occurs.

Performance Audit - an audit in which quantitative data are independently obtained for comparison with routinely obtained data in a measurement system to evaluate the proficiency of an analyst or laboratory.

Polychlorinated Biphenyl (PCB) - One of several aromatic compounds containing two benzene nuclei with two or more substituent chlorine atoms. They are highly toxic colourless liquids with sp. gr. of 1.4 to 1.5. Because of their persistence and contribution to ecological damage from water pollution their manufacture was discontinued in the U.S. in 1976.

Polycyclic Aromatic Hydrocarbon (PAH) - One of several aromatic compounds composed of two or more benzene rings (*e.g.*, naphthalene, anthracene). Some PAHs are highly carcinogenic (*e.g.*, benzo[a]pyrene). PAHs are also known as Polynuclear Aromatic Hydrocarbons or Polycyclic Organic Matter.

Precision - the degree of mutual agreement among individual measurements of the same property, usually obtained under similar conditions. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preventive Maintenance - an orderly program of positive actions for preventing failure of equipment and ensuring, insofar as possible, that the equipment is operating with the reliability required for the production of quality results.

Primary Reference Standard - a homogeneous material with specific properties, such as identity, purity, and potency, that has been measured and certified by a qualified and recognized organization.

Primary Standard - a substance or device, the value of which can be accepted (within specific limits) without question when used to establish the value of the same or related property of another material.

Protocol - a highly detailed written procedure to be used when performing a measurement or related operation.

Quality - the totality of features and characteristics of a product or service that bear on its ability to satisfy given needs.

Quality Assessment - the overall system of activities whose purpose is to provide assurance that the quality control activities are applied effectively. It involves a continuing evaluation of performance of the production system and the quality of the products produced.

Quality Assurance - an integrated system of activities in the area of quality planning, quality control, quality assessment and quality improvement to provide to the producer or user of a product or service the assurance that it meets defined standards of quality.

Quality Assurance Program Plan - a formal document which describes an orderly assembly of management policies, objectives, principles, organizational responsibilities, and procedures by which an agency or laboratory specifies how it intends to a) produce data of documented quality to meet the user's needs, and b) provide for the preparation of Data Quality Objectives, Quality Assurance Projects Plans, and Standard Operating Procedures.

Quality Assurance Project Plan - an orderly assembly of detailed and specific procedures by which an organization or laboratory delineates how it produces data of the quality required by the data user for a specific project.

Quality Control - the overall system of activities whose purpose is to control the quality of a product or service so that it meets the needs of users. The aim is to provide quality that is satisfactory, adequate, dependable, and economic.

Random Error - that portion of the variance in repeated measurements that is random in nature and individually not predictable. The causes of random error are assumed to be indeterminate and/or unassignable. The distribution of random error is generally assumed to be normal (i.e., Gaussian).

Raw Data - any laboratory worksheets, records, memoranda, notes, or exact copies thereof, that are the results of original observations and activities of a measurement or study and are necessary for the reconstruction and evaluation of the report of that study. In the event that exact transcripts of data have been prepared (e.g., tapes which have been transcribed verbatim, dated, and verified accurate by signature), the exact copy or exact transcript may be substituted. Raw data may include photographs, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

RDMQ™ - the Research Data Management Quality Control System (RDMQ™) is a SAS menu driven application with facilities for loading data, applying quality control checks, viewing and changing data, producing tabular and graphical reports and exporting data in ASCII files or html format. RDMQ™ provides a shell environment which allows the end-user to perform these tasks in a

structured manner. The end-user creates the databases and quality control checks through a user friendly interface.

Recovery - the fraction of analytes or materials of interest recovered by an analytical method from a sample containing a known amount of the materials of interest.

Reference Material (RM) - a material or substance, one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for the assignment of values to materials.

Reference Method - a sampling and/or measurement method which has been officially specified by an organization as meeting its data quality requirements.

Reference Standard - material incorporating analyte(s) of interest having known concentration(s) and purity. Such materials are used to calibrate the measurement system or verify that the initial standard curve is in effect (i.e., no instrument drift, plugging of critical orifices, etc., has occurred).

Relative Standard Deviation - see "coefficient of variation."

Replicability - the precision, usually expressed as a standard deviation, measuring the variability among replicates.

Replicate Sample - two or more samples taken from the same source at the same time and processed (handled or analyzed) under identical conditions.

Representativeness - the degree to which data accurately and precisely represent a characteristic of a population.

Sample Custody - a defined procedure for establishing, verifying, and documenting the security, handling, and processing of samples and/or data from the time of sample collection through data processing and reporting.

Spike - a known mass added for the purpose of determining recovery, or for quality control.

Split Sample - a sample which has been divided into aliquots and processed by a different analyst.

Standard Deviation - the most common measure of the dispersion of observed values or results expressed as the positive square root of the variance.

Standard Materials - individuals or mixtures of target parameters of known concentrations and purities that are used for standardization of the measurement system. These are preferably highly purified reagents or samples traceable to a certifying organization.

Standard Method - a method or procedure on consensus opinion or other criteria and often evaluated for its reliability by collaborative testing and has organizational approval.

Standard Operating Procedure (SOP) - a written document which details an operation, analysis or action whose mechanisms are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Standard Reference Material (SRM) - a material produced in quantity, of which certain properties have been certified by the National Institute of Standards and Technology (NIST) or other agencies to the extent possible to satisfy its intended use.

Surrogate - a pure substance to be added to environmental samples for quality control purposes which is not likely to be found in an environmental sample but which mimics the analyte of interest.

System Audit - a systematic on-site qualitative review of facilities, equipment, training, procedures, record keeping, data validation, data management, and reporting aspects of a total (QA) system, a) to arrive at a measure of capability of the measurement system to generate data of the required quality, and/or b) to determine the extent of compliance of an operational QA system to the approved QA project plan.

Traceability - the ability to trace the source of authenticity and/or uncertainty of a measurement, a measured value, a document, or a working standard.

Trip Blanks – Samples of analyte – free media taken from the laboratory to the sampling site and returned to the laboratory unopened. They are used to measure cross – contamination from the container and preservative during transport, field handling and storage.

Uncertainty - an indication of the variability associated with a measured value that takes into account two major components of error; bias, and the random error attributed to the imprecision of the measurement process.

Validation - the process by which a sample, measurement method, or a piece of data is deemed useful for a specified purpose.

Variance (as defined mathematically) - a measure of dispersion; it is the sum of the squares of the difference between the individual values of a set and the arithmetic mean of the set, divided by one less than the number of values.

APPENDIX B - IADN IMPLEMENTATION PLAN

Second Implementation Plan for the Integrated Atmospheric Deposition Network 1998-2004

{DRAFT Jan. 1998}

June 1998

Environment Canada
4905 Dufferin Street
Downsview, Ontario Canada

Great Lakes National Program Office
United States Environmental Protection Agency
77 W. Jackson
Chicago, IL USA

Commitment of the Parties

The following Implementation Plan commits the Parties to the Great Lakes Water Quality Agreement to maintain the Integrated Atmospheric Deposition Network as called for under Annex 15 of the Great Lakes Water Quality Agreement.

Dated:

_____

Mr. John Mills
Regional Director General
Environment Canada

_____

Mr. David A. Ullrich
Acting Great Lakes National Program Manager
Great Lakes National Program Office
U.S. Environmental Protection Agency

Purpose and Scope

The Integrated Atmospheric Deposition Network (IADN) has been in operation since 1990 under the guidance of an implementation plan signed in that year (Egar and Adamkus, 1990). The first implementation plan (IP1) committed the United States and Canada to work cooperatively towards the initiation of the IADN and guided the five cooperating IADN agencies (the U.S. Environmental Protection Agency; Environment Canada's Atmospheric Environment Service, National Water Research Institute, Ecosystem Health Division of Ontario Region; and the Ontario Ministry of Environment) in meeting their joint obligation. In 1997, the progress of the IADN program was reviewed in a technical summary (IADN Steering Committee, 1997; hereafter called TS). The TS has been widely distributed for comment and has been the subject of a Peer Review by eminent scientists of international stature.

This document is the Second Implementation Plan of IADN (IP2). It is designed to restate the goals of IADN, briefly outline the future plans for IADN for the period 1998-2004, and provide a timeline from which the IADN yearly workplans will be developed. This is not a stand-alone document. The details of IADN necessary to understand IADN's aims and goals are more fully discussed in the TS and it is expected that the two documents will be used in tandem by those seeking to understand the IADN program in detail.

IADN Mandate and Goal

IADN is specifically called for, by name, in Annex 15 of the Great Lakes Water Quality Agreement (GLWQA). In Canada, these activities are reflected in the Canada-Ontario Agreement (COA). The mandate for IADN also resides in Section 112(m) of the U.S. Clean Air Act Amendments of 1990 (CAA). More recently, the U.S./Canada Binational Great Lakes Toxics Strategy (BGLTS), signed in 1997, calls for monitoring of the atmospheric deposition of toxic chemicals to the Great Lakes basin. Many of the "challenges" in the BGLTS are directly related to IADN capabilities and goals.

The **goals** of IADN **are** to:

1. **Determine**, with a specified degree of confidence, the atmospheric **loadings** and **trends** (both spatial and temporal) of **priority toxic chemicals** to the Great Lakes and its basin on, at least, a biennial basis;
2. **Acquire** quality-assured **air and precipitation concentration measurements**, with attention to continuity and consistency of those measurements, so that trend data are not biased by changes in network operations or personnel; and
3. Help **determine** the **sources** of the continuing input of those chemicals.

"***Loading***" of these chemicals is defined as the net flux of the chemical to the water or watershed in units of mass per square meter per unit time or, when multiplied by the surface area of the receiving surface, mass per year. This definition included losses from the surface as a result of gas exchange. "***Trends***" are defined as the yearly rate of change or spatial differences in the loading of a specific chemical, determined from a significantly long time series of data so that the statistical certainty in the estimate of the rate can be stated with a specified degree of confidence. A "***specified degree of confidence***" means that the loadings and trends are qualified by a measure of the precision of the estimate (usually in terms of one standard deviation of the loading estimate or a statement of the statistical power of the trend determination, i.e. positive or negative slope at the 95% confidence level). "***Priority toxic chemicals***" are those chemicals which, through listing by the IJC or the Parties, are of known concern to the Lakes, including chemicals which are suspected to be an ecosystem problem for the Lakes and are currently under research investigation or assessment. It is clear by this goal that IADN is an evolving program which will include the investigation of new chemical inputs to the Lakes.

IADN Design

This Implementation Plan is designed to allow for some revision to IADN operations during the next six year period. IADN will change as requirements for its data changes. Changes to IADN activities will be documented (as they occur) by frequent updating of the IADN Quality Assurance Program Plan (QAPP). The QAPP is designed to be a "living document" and will provide detailed and accurate descriptions of program activities, personnel and their responsibilities, and status on the quality of the data provided by the network. The IADN QAPP will be updated during 1998.

Station Placement and Number

IADN has been designed around the concept of one Master Station on each of the five Great Lakes, supplemented by a number of Satellite Stations which provide more spatial detail in deposition. The Master Stations offer the complete range of measurements made in the Network, measuring wet and dry deposition of Semivolatile Organic Compounds (SVOCs), trace metals, and particulate mass less than 10 um (PM10). Satellite Stations may contain only a portion of the measurements made at the Master Stations. From the measurement of air concentrations of the SVOCs at these sites and in combination with measurements of the water concentration of the same chemicals made by other programs, IADN also estimates gas exchange of the SVOCs with the lake surfaces. The current IADN station placement is shown in Figure II-1 of the TS.

IADN will continue with the current design, however, rationalization of the placement and number of the Satellite Stations will occur during the first two years of IP2. This rationalization involves an assessment of the need for certain satellite stations using the spatial trend information derived to date. It has been pointed out in the IADN Peer Review that urban influences and direct measures of air-water exchange may be a higher scientific priority than high spatial detail across the lakes. A workshop will be held early in the IP2 period to examine more strategic placement of the Satellite Stations to improve IADN's capability to assess the effects of urban areas on lakewide loadings.

IADN will develop one or more paired urban/rural or urban/remote stations to assess the impact of large urban areas on the Lakes. This will involve moving one or more Satellite stations into cities such as Toronto, Detroit, or Buffalo and making measurements in parallel with existing IADN stations. Canada proposes that Toronto/Egbert/Point Petre be the urban/rural/remote intercomparison sites for Lakes Ontario and Huron. The US proposes assessing the feasibility of establishing similar paired sites at the existing Chicago urban site and a remote site or at Sturgeon Point/Buffalo. Other possible pairings exist at Detroit and Walpole Island (a National Air Pollution Surveillance site) or Detroit/Grand Bend.

Air-water exchange needs to be addressed in a more systematic fashion. The current procedure of comparing near-shore measurement of organics in air with mid-lake water concentrations (often with a time offset) has been challenged as inadequate. During the first two years of IP2, IADN will assess the feasibility of maintaining a routine monitoring site over the waters of one Great Lake. This may be accomplished either by the use of a buoy, crib or island site. The site will be maintained and monitored on a year-round basis. U. S. EPA will assess the feasibility of utilizing the Research Vessel Lake Guardian and other options for routine paired air/water sampling over one or more of the Great Lakes. Environment Canada will endeavour to utilize lakewide cruises as well as a mid-lake buoy for the acquisition of over-water air concentration measurements simultaneously with whole water samples.

Current Master Stations at Eagle Harbor (Superior), Sleeping Bear Dunes (Michigan), Burnt Island (Huron), Sturgeon Point (Erie) and Point Petre (Ontario) are important, not only because of their strategic placement, but because of the developing time series of data from these sites. These sites should be retained throughout IP2 in order to maintain continuity of record for the assessment of trends. Satellite facilities are equally important for their data input; however, the priority of maintenence of the sites should be based on scientific need and the historical seniority of the stations (i.e. stations with a long record should be retained as a priority).

Chemicals Measured

Table 1: IP1 Chemical List

IP1 Tier 1 **"Achievable" chemicals**
PCBs (total and congeners)
α - HCH
γ - HCH
Benzo(*a*)pyrene
Pb
IP1 Tier 2 **"Method Development Needed"**
∑DDT
Chlordane
Nonachlor
Heptachlor epoxide
Methoxychlor
Dieldrin
Hexachlorobenzene
Endrin
As
Se
Cd
Hg
IP1 Tier 3 **"Extensive Methodology Development Needed"**
Chlorobenzenes
PAHs
Toxaphene
co-planar PCBs
Dioxins/Furans
Agrochemicals
Industrial chemicals

IP1 called for the measurement of PCBs, α and γ-HCH, Pb and PAHs (with B(a)P) as a target. A second tier of chemicals was to be added as methods were confirmed and a third tier of chemicals were to have methods developed. IP2 will take the same approach. Tier 1 chemicals are those for which routine methods exist and it can be expected that IADN will continue to produce quality assured data for the full period. The Tier 1 chemical list is under review and certain chemicals and isomers are being examined to determine the necessity of their continued measurement. For example, many PCB congeners which are currently measured do not strictly fall under the Tier 1 category because although they can be detected in standard samples, their concentration in the environment is so low in precipitation or the gas or particle phases in air that they are routinely *not detected.* A workshop will be held early in the IP2 period to confirm criteria for inclusion of PCB congeners into the IP2 list.

One activity will use completeness criteria in the IADN QAPP to eliminate certain chemicals which are not seen in at least one season of the year. This reduction in chemical number will result in some economies of measurement and reporting. New chemicals will also be investigated during IP2. The procedures for the addition and deletion of chemicals from the monitoring list will be developed early in the IP2 period.

Table 2. Chemical lists, as suggested for review during early IP2 period.

Proposed IP2 Tier 1 **"Achievable" chemicals**	
PCBs (limited suite and ΣPCB)	***Polycyclic aromatic compounds:***
Organochlorine pesticides:	Phenanthrene
	Acenaphthylene
α - HCH	Acenaphthene
γ - HCH	Fluorene
Dieldrin	Anthracene
trans-Chlordane (γ)	Fluoranthene
cis-Chlordane (α)	Pyrene
trans-Nonachlor	Benzo(*ghi*)fluoranthene
α-endosulphan (I)	Benz(*a*)anthracene
β-endosulphan (II)	Chrysene
p,p'-DDT	Benzo(*e*)pyrene
p,p'-DDD	Benzo(*a*)pyrene
p,p'-DDE	Benzo(*b*)fluoranthene
Hexachlorobenzene	Benzo(*k*)fluoranthene
Trace elements:	dibenzo(*ac*)anthracene
Pb	benzo(*ghi*)perylene
Se	Indeno(*123,cd*)pyrene
Cd	Anthanthrene
As	Retene
Proposed IP2 Tier 2 **"Method Development Necessary (non-routine analyses)"**	
β-HCH	
Heptachlor	
Heptachlor Epoxide	
Methoxychlor	
o,p-DDD	
o,p-DDT	
co-planar PCBs (77, 126)	
Toxaphene (at two Master Stations only)	
Atrazine and selected triazine herbicides	
Dioxins/Furans (at some urban sites)	
Hg^0(gas phase), Hg^{++} (particulate, precip.)	
Proposed IP2 Tier 3 **"Extensive Methodology Development Needed"**	
Endocrine disrupting compounds not currently on Tier 1 and 2 lists	
Chlorobenzenes	
Industrial chemicals (chlorinated naphthalenes, chlorinated paraffins)	
New pesticides and herbicides (e.g. moderately persistent OP pesticides)	

Table 1 states the chemicals and classes of chemicals currently under Tier 1, 2, and 3 status. Table 2 shows a proposed revised list of chemicals. This list will be finalized by June 1998. This list will be submitted to interested parties (States and non-governmental agencies) for comment during the Spring of 1998. The chemicals workshop will develop criteria for inclusion of chemicals into the IADN QAPP.

Research Needs under IADN

Annex 15 calls for Research to accompany the IADN Surveillance/Monitoring Activities. Most of these Research needs (assessment of long-range transport, modelling, etc.) have been unfunded during the IP1 period. The U.S. has carried out some of these activities (AEOLOS, for example) in parallel to, but not in coordination, with IADN. The IADN Peer Review Panel

recommended better coordination of these efforts with IADN and this makes sense.

Redirection of IADN to resolve research questions is not only impossible with existing resources but may likely involve the wrong personnel, since IADN measurement staff are not modellers and vice-versa. It is recommended that a separate Annex 15 Research Plan be created which will address the neglected activities under Annex 15 and better coordinate activities between the Parties on Research.

IADN does have a measurement research component which leads to better estimates of loadings, measurements, and trends. Research, which will lead to a better assessment of mass transfer coefficients, Henry's law constants, deposition velocities, gas/particle partitioning, will be undertaken under the IP2, subject to available resources. There is some additional funding flexibility in Canada during the IP2 period and increased activity on Research questions is expect.

IADN Quality Assurance/Quality Control

QA/QC has been the hallmark of the IADN program during the IP1 period. As a result, the IADN Peer Review panel has recognized the importance and validity of data obtained from IADN. This QA/QC program will continue and be augmented. The IADN Quality Assurance Program Plan (QAPP) will be revised for the IP2 period to reflect the changes in the program which have developed over the first six years. The Standard Operating Procedures manuals for each agency will also be updated. The strong round-robin laboratory intercomparison series will be continued at least on a biennial basis. Further work on field intercomparisons will be conducted with the renewal of multi-agency sampling at one IADN site (Point Petre), designed to link the measurements made by the various agencies contributing to IADN.

Significant progress has been made in the unification of quality assurance and data analysis techniques. All agencies in the Network are participating in the use of the Research Data Management and Quality Assurance System (RDMQ). This participation will continue. RDMQ provides front-line quality assessment of the data entering the data analysis stream and, as such, a unified treatment of the data is required. Environment Canada commits to maintain the RDMQ infrastructure and data input by the Data Officer. This system provides a crucial link in the submission of the data to the ultimate database repositories.

IADN will have a designated QA/QC Officer (or officers, one on each side of the border). This Officer will oversee the maintenance of the documentation, implementation of the intercomparison studies, QA/QC screening of the data, and provide annual QA/QC reports on the activities of the QA/QC program. The QA/QC officers will work with the IADN Principal Investigators to make the QC program a continuing activity, involving the exchange of standards, samples and extracts, side-by-side replicate samples, improvement of detection limits, maintenance of the QAPP, etc.

Data Analysis and Reporting

The IP1 period has had a good record of biennial reporting of the data from the IADN through journal articles and reports. The data analysis which has gone into these reports has been developmental and evolutionary. The data analytical tools used to derive the loads and trends of IADN data will be formalized using the data reporting system and specifically outlined in the IADN QAPP. Environment Canada has committed to providing the database structure for the IADN data through the National Air Chemistry Database (NATCHEM/Particles). The status of the IADN data in the NATCHEM/Particles system is directly accessible via the World Wide Web and provides regular updates on the data status.

NATCHEM/Particles has sufficient infrastructure to service routine requests for data from the network. The provision of data to outside users will be structured to comply with the requests for data. Since much of the IADN data will have undergone significant QA/QC and manipulative analyses to reach NATCHEM status, provision of data will be patterned to user needs (e.g., invalidated data will be removed from output data files, qualified data may or may not be removed depending on the sophistication of the user). Decisions of release of raw or individual sample data

will be made by the IADN Steering Committee (including the PI whose data is in question) in cooperation with the NATCHEM Manager.

Higher level products which have undergone internal and external reviews (seasonal and annual loading data, trend data, publications, etc.) will be provided to the public via World Wide Web access. These products will be updated at least twice per year and the site will be maintained by the Environment Canada data analysis team (the IADN Data Officer, the NATCHEM Manager and their staff, with review by the IADN Steering Committee). A mirror site at the USEPA will be provided. These sites will both contain US and Canadian logos. A goal of the data analysis effort is to have data released to the public within 18 months of the date of sample collection.

IADN has been chided by the Peer Review panel as being "one of the best kept secrets around". The Parties require the IADN Steering Committee to report on IADN activities on a biennial basis. In addition, IADN will use a number of fora (conferences, public meetings, WWW, journal feature articles, etc.) to distribute information and data. A mechanism for encouraging such dissemination of results are biennial IADN reviews to be held in alternate years in Chicago/Washington and Toronto/Ottawa. These reviews will involve policy makers and analysts, as well as other Federal, Provincial and State agencies, LaMP and RAP participants, and non-governmental organisations. These reviews will be held in October. A written report of progress will accompany these reviews.

Implementation Timetable

As in IP1, this Implementation Plan contains a timetable of IADN developments and progress. This timetable is shown in Table 3.

References:

Egar, D. L. and V. V. Adamkus (1990). *Integrated Atmospheric Deposition Network Implementation Plan.* Environment Canada, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4, 12 p. (URL: http://www.msc-smc.ec.gc.ca/iadn/resources/IP1.pdf)
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IADN Steering Committee (1997) *Technical Summary of Progress Under the Integrated Atmospheric Deposition Program 1990-1996.* R. M. Hoff, ed., Environment Canada, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4, 101p.
(URL: http://airquality.tor.ec.gc.ca/IADN/IP2.htm)

Table 3: Long Term Implementation Timeline

PHASE I – JUNE 1, 1998 - MAY 31, 2000	**PHASE II - JUNE 1, 2000 - MAY 31, 2002**	**PHASE III - JUNE 1, 2002 - MAY 31, 2004**
• Conduct Data Workshop (June 1998) to: ⇒ review air and precipitation data collected from co-location at Point Petre during 1990-1994 ⇒ update loadings and publish results ⇒ assess feasibility of maintaining a routine monitoring site over water; if feasible, establish site • Conduct Chemicals Workshop (October 1998) to: ⇒ establish criteria for maintaining/adding chemicals to list, and revise chemical list ⇒ harmonize sampling and analytical techniques ⇒ rationalize number and placement of Satellite Stations ⇒ develop criteria for urban sites, determine feasibility of establishing paired urban/rural/remote sites, and establish urban sites • Conduct paired air/water sampling on the Great Lakes • Conduct round-robin interlaboratory studies and site audits • Establish WWW access to information products • Conduct IADN information session and review in Toronto/Ottawa (October 1999). • IADN Progress Report (October 1999)	• Conduct Loadings Workshop (June 2000) to update loadings and publish results; • Conduct paired air/water sampling on the Great Lakes • Conduct round-robin interlaboratory studies and site audits • Update WWW products • Conduct IADN information session and review in Chicago/Washington (October 2001) • IADN Progress Report (October 2001) • Conduct Workshop (October 2000) to: ⇒ revise chemical list ⇒ rationalize number and placement of Satellite Stations ⇒ harmonize sampling and analytical techniques	• Conduct Loadings Workshop (June 2002) to update loadings and publish results; and to review chemical list • Conduct paired air/water sampling on the Great Lakes • Conduct round-robin interlaboratory studies and site audits • Update WWW products • Conduct IADN information session and review in Toronto/Ottawa (October 2003) • IADN Progress Report (October 2003) • Conduct IADN Peer Review and IP3 consultations (January 2004) • Finalize IP3 proposal (March 2004)

APPENDIX C - IADN SITING CRITERIA

IADN SITING CRITERIA

. The primary siting criteria is that the sites be representative of the regional atmospheric environment over the Lakes. All variances from these criteria should be noted on a standard siting checklist and a site map including a 1 km radius around the site. In general only minor deviations from these criteria should be allowed for master sites. More significant deviations are permitted for satellite sites; however, there should be no more than one major source nearby and it should be downwind during prevailing winds.

. Sites should be at least 40 km from major sources such as larger urban centers (pop. > 10,000), heavy industry (chemical plants, foundries, steel mills, smelters, refineries, pulp and paper mills) or other major sources for airborne metals or organic chemicals (large incinerators, power plants emitting more than 10,000 tons/yr SO2, NOX or 100 kg/yr total PAH, major airports, large sewage treatment works).

. Sites should be at least 10 km from other important sources such as urban areas (pop. = 1,000 to 10,000), mining and manufacturing facilities, major highways, commercial areas, electrical transfer stations or smaller sources (lower by a factor of 10) in the categories listed in criterion number 2.

. Sites should be at least 1 km from local sources such as vehicle or boat traffic (>30 vehicles/hr), farms and tilled fields (in regions where farming is not the predominant land use), fuel or chemical storage areas, landfills, sewage lagoons or small towns (pop.<1,000). The use of pesticides in farming operations within 1 km of the sites should be documented.

. Sites should be at least 250 m from single residences, parking lots, grazing animals, public roads (<30 vehicles/hr) and other sources in the immediate area of the samplers. Single residences within 1 km of the site should be downwind during prevailing winds or outside of a 22.5□ sector on each side of the prevailing wind direction. For all residences within 500 m of the site, type of heating and fuel usage, open burning and use of household chemicals on the Annex 1 list should be documented.

. Samplers should be sited on open level terrain (slope <15%) with regionally representative ground cover (preferably grass with a height of no more than 20 cm). The samplers should subtend a vertical angle of less than 30^{o} (2:1 fetch to obstruction height) with any obstruction (trees, towers, power lines). This should be increased to 10:1 for solid structures. In areas with high snowfall, the site should be sheltered by trees at a distance between 2.5 and 4 times their height. The samplers

should be on a 1 m platform or no higher than the maximum snowpack.

. Samplers should be no more than 1 km from the lake shore. Where there is a choice, sites should be situated so that prevailing winds are onshore from the lake. Protection by trees from wind and lake spray at a distance from 2.5 to 4 times tree height is also desirable.

. Sites should have all-weather access, electrical power (200 amp, 125 v) and a security fence if not otherwise secured. Sites should be large enough to allow a 2 m spacing between samplers.

. No development (industry, construction) should be planned in the vicinity of the site (1 km) and the site owner should agree to continuous operation of the site for at least 5 years.

APPENDIX D – IADN NETWORK DETAILS

IADN Network Details

IADN Sites

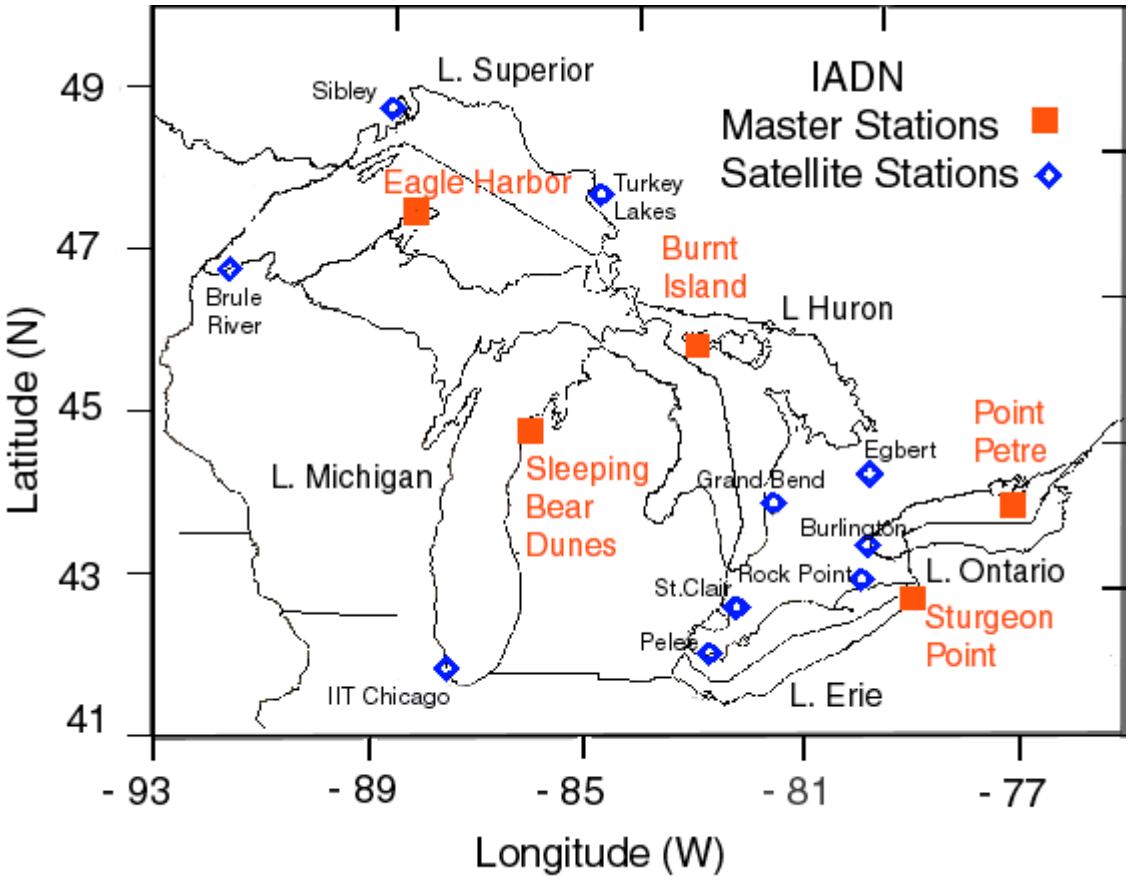

Figure D-1. Locations of current sampling stations.

Station locations. Figure D-1 illustrates the location of all air and precipitation stations contributing information to IADN. It is intended that each station meet the IADN siting criteria which were developed to ensure regional representativeness.

Siting Criteria. In 1990, the IADN Operations Working Group established the siting criteria for IADN. Nine siting criteria were selected:

1. Sites should be regionally representative (within 1 km of the sites land use should represent the surrounding area out to 40km). Satellite sites may deviate more from this criterion.

2. Sites should be >40km from population areas of >10000 inhabitants, heavy industry, or other major sources of air pollutants.

3. Sites should be >10km from other important sources (population 1000-10000), mining, manufacturing facilities, major highways, commercial areas, electrical transfer stations or sources ten times smaller than those in criterion 2.

4. Sites should be >1km from local sources, such as boat traffic (>30 vehicles/hr), farms or tilled fields, fuel or storage areas, landfills, sewage lagoons or small towns (<1000). Where pesticides are used within the 1 km radius, their use should be documented.

5. Sites should be >250m from single residences, parking lots, grazing animals, public roads. Where residences are 250-1000m from the site, they should be outside of a 22.5° sector on either side of the prevailing wind.

6. Samplers should be on level terrain (slope <15%) with regionally representative ground cover. Samplers should subtend a vertical angle of less than 30° with any obstruction (trees, towers, power lines). In areas of high snowfall, the site should be sheltered by trees at a distance of 2.5 to 4 times their height. Samplers should be on 1 m platforms.

7. Sites should be no more than 1 km from the lake shore. Sites should preferentially be placed so that prevailing winds are off the lake.

8. Sites should have all weather access, sufficient electrical power and a security fence. 2m spacing between samplers is desired.

9. No development within 1 km of the site is planned, and the site should be viable for at least 5 years.

There is one Master Station located on each of the Great Lakes; siting location information is provided in Table D-1. For the Master Stations, only Sturgeon Point does not meet all of these siting criteria. Finding a site for Lake Erie proved to be difficult because considerable development exists all along the Lake Erie shorefront. Sturgeon Point was the best compromise site for the U.S. side of Lake Erie.

Table D-1. IADN Master Station locations .

LAKE	SITE	LATITUDE	LONGITUDE	HEIGHT (MASL)	LEAD AGENCY	YEAR STARTED
Superior	Eagle Harbor	47° 27'47"	88° 08'59"	185	EPA	1990
Michigan	Sleeping Bear Dunes	44° 45'40"	86° 03'31"	241	EPA	1991
Huron	Burnt Island	45° 49'42"	82° 56'53"	180	EC	1992
Erie	Sturgeon Point	42° 41'35"	79° 03'18"	176	EPA	1991
Ontario	Pt. Petre	43° 50'34"	77° 09'13"	75	EC	1988

Prior to the establishment of IADN, there were several existing monitoring networks operating in Canada that were relevant to IADN. These included:

1. Ontario Ministry of the Environment's seven station Air Toxics Network (reduced to 4 stations in 1996; discontinued entirely in 2000);
2. Environment Canada (Ontario Region), Ecosystem Health Division's eight-station precipitation-only network; and
3. Meteorological Services Canada's air-only station at Egbert.

Since these other networks were linked by cooperative sampling at the Master Stations, Canada made a decision in 1995 to treat these as satellite facilities, as called for in IP1.

In the U.S., two additional sites which were included as part of the Lake Michigan Mass Balance Project were similarly included in IADN:

4. Illinois Institute of Technology in Chicago; and
5. Brule River in Wisconsin.

Table D-2 provides details re the satellite stations.

Table D-2. Satellite facilities under IADN.

LAKE	STATION	LATITUDE	LONGITUDE	LEAD AGENCY FOR SITE	MEASUREMENT	START DATE (AND END DATE)
Superior	Sibley	48° 29' 48"	88° 41' 05"	EHD	Precip. organics; metals	1978
Superior	Turkey Lakes	47° 02' 05"	84° 22' 50"	"	"	1981
St. Clair	St. Clair	42° 22' 50"	82° 24' 15"	"	"	1991
Erie	Pelee Is.	41° 58' 06"	82° 31' 16"	"	"	1994
Erie	Rock Point	42° 50' 51"	79° 32' 44"	"	"	1994
Ontario (urban)	Burlington	43° 22' 36"	79° 50' 54"	"	"	1992
Ontario (urban)	Metro Zoo	43° 52' 21"	79° 11' 18"	"	"	1992 (1997)
Superior	Wolf Ridge	47° 23' 00"	91° 12' 25"	OME	All	1990 (2000)
Huron	Grand Bend	43° 20' 13"	81° 44' 25"	EHD (OME)	"	1991 (2000 for OME)
Huron (rural)	Dorset	45° 13' 26"	78° 55' 52"	OME	"	1989 (2000)
Erie	Port Stanley	42° 40' 22"	81° 09' 55"	"	"	1989 (2000)
Huron (rural)	Egbert	44° 13' 57"	79° 46' 53"	MSC	Air organics and metals	1988
Superior	Brule River	46° 44' 51"	91° 36' 30"	EPA	All	1993
Michigan (urban)	IIT-Chicago	41° 50' 04"	87° 37' 29"	EPA	All	1994

Parameters measured by each agency Section 1.4.2 provides the list of chemicals to be measured under IADN; however, each agency measures a greater range of chemicals. Tables D-3 through D-5 show the list of chemicals monitored by each agency and the medium in which they are measured (air or precipitation)

Table D-3: Organochlorine compounds measured by agency

		MSC	EHD	IU	IU	IU
		Vapour	Precip.	Precip.	Part.	Vapour
Stand. Name	CAS Number; Alt. Name	(ng/samp.)	(ng/samp.)	(ng/samp.)	(ng/samp.)	(ng/samp.)
A_HCH	319-84-6	x	x	x	x	x
B_HCH	319-85-7	x	x	x	x	x
D_HCH	319-86-8	x				
G_HCH	58-89-9; Lindane	x	x	x	x	x
ALDRIN	309-00-2	x	x	x	x	x
DIELD	60-57-1	x	x	x	x	x
ENDRIN	70-20-8	x	x	x	x	x
G_CHLOR	5103-74-2; trans-chlordane;	x	x	x	x	x
A_CHLOR	5103-71-9; cis-chlordane	x	x	x	x	x
T_NONA	39765-80-5	x	x	x	x	x
OXYCHLR	26880-48-8	x		x	x	x
HEPTCHL	76-44-8	x	x			
HEPTEPO	1024-57-3	x	x	x	x	x
MIREX	2385-85-5	x	x			
PHOTMIR	39801-14-4	x				
A_ENDOS	959-98-8; a-endosulfan	x	x	x	x	x
B_ENDOS	33213-65-9; b-endosulfan	x	x	x	x	x
OP_DDT	784-02-6; 1,1,1-trichloro-2-(o-chlorophenyl)-2-(p-chlorophenyl)ethane	x	x	x	x	x
PP_DDT	50-29-3; 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane	x	x	x	x	x
OP_DDD	53-19-0	x				
PP_DDD	72-54-8; 2,2-bis(p-chlorophenyl)-1,1-dichloroethane	x	x	x	x	x
PP_DDE	72-55-9; 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene	x	x	x	x	x
METHOXY	72-43-5; methoxychlor	x	x	x	x	x
HCB	118-74-1; hexachlorobenzene	x	x	x	x	x

Table D-4: Polynuclear aromatic hydrocarbons measured by agency and medium

PAHS:		MSC	EHD	IU	IU	IU
		Vapour	Precip	Precip	Part.	Vapour
Stand. Name	CAS Number; Alt. Name	(ng/samp.)	(ng/samp.)	(ng/samp.)	(ng/samp.)	(ng/samp.)
ACENY	208-96-8; Acenaphthylene	x	x	x	x	x
ACEN	83-32-9; Acenaphthene	x	x	x	x	x
FLUOR	86-73-7; Fluorene	x	x	x	x	x
PHEN	85-01-8; Phenanthrene	x	x	x	x	x
ANTHRAC	120-12-7; Anthracene	x	x	x	x	x
FLUORT	206-44-0; Fluoranthene	x	x	x	x	x
PYR	129-00-0; Pyrene	x	x	x	x	x
TRIP	217-59-4; Triphenylene	x	x			
B_GHI_F	203-12-3; B(ghi)F	x				
B_A_A	56-55-3; B(a)A	x	x	x	x	x
CHRY	218-01-9; Chrysene	x	x	x	x	x
B_E_P	192-97-2; B(e)P	x		x	x	x
B_B_F	205-99-2; B(b)F	x	x	x	x	x
B_K_F	207-08-9; B(k)F	x	x	x	x	x
D_AC_A	215-58-7; dB(ac)A	x				
B_A_P	50-32-8; B(a)P	x	x	x	x	x
D_AH_A	53-70-3; dB(ah)A	x	x	x	x	x
B_GHI_P	191-24-2; B(ghi)P	x	x	x	x	x
INDENO	193-39-5; I(123cd)P	x	x	x	x	x
ANTHAN	191-26-4; Anthanthrene	x				
RETENE	483-65-8; Retene			x	x	x
INDENE	95-13-6; indene		x			
CORON	191-07-1; Coronene			x	x	x

Table D-5: Additional Trace Elements measured by agency and medium

ELEMENT	MSC AIR - NAA[A]	MSC AIR -ICP[B] ICP	EHD PRECIP.
		x	
Ba		x	x
Be		x	
Bi		x	
Br	x		
Ca	x		x
Ce	x		
Cl	x		x
Co	x		x
Cs	x		
Fe	x	x	x
Hf	x		
I	x		
In	x		
K	x		x
La	x		
Mg			x
Mn	x	x	x
Mo		x	
Na	x		x
Ni	x		x
P		x	x
Rb	x		
S			
Sb	x		
Sc	x		
Si	x		x
Sr		x	x
Sn	x		
Ta	x		
Th	x		
Ti	x		
U	x		
V	x	x	x
W	x		

[a] NAA Analysis performed by Dr. Sheldon Landsberger (University of Texas - Austin)
[b] ICP analysis performed by Philip Analytical Laboratories (Burlington, Ontario)

Table D-6. PCB Congeners analyzed by each agency

TABLE D-6. PCB CONGENERS

BZ NUMBER	TYPE	CONGENER	CAS NUMBER	MULLIN STD. (1989)	MSC (A)	NLET (P)	OME	IU
1	mono	2-	2051-60-7	Y	Y	Y		
2	mono	3-	2051-61-8					
3	mono	4-	2051-62-9	Y	Y	Y		
4	di	2,2'-	13029-08-8	Y[1]	Y[2]	Y+		Y+
5	di	2,3-	16605-91-7	Y[1]	Y[2],S	Y+	Y,R	Y+
6	di	2,3'-	25569-80-6	Y	Y,S	Y	Y,R	Y,H
7	di	2,4-	33284-50-3	Y	Y	Y+		Y+
8	di	2,4'-	34883-43-7	Y[1]	Y[2],S	Y+	Y,R	Y+
9	di	2,5-	34883-39-1			Y+		Y+
10	di	2,6-	33146-45-1	Y[1]	Y[2]	Y+		Y+
11*	di	3,3'-	2050-67-1					
12*	di	3,4-	2974-92-7	Y[1]	Y[2]	Y+		Y
13*	di	3,4'-	2974-90-5	Y[1]	Y[2]	Y+		Y
14*	di	3,5-	34883-41-5					Surr
15□	Di	4,4'-	2050-68-2		Y[2]	Y+,R	Y,R	Y+
16	Tri	2,2',3-	38444-78-9	Y[1]	Y[2],S	Y+	Y,R	Y
17	Tri	2,2',4-	37680-66-3	Y	Y[2],S	Y+	Y,R	Y+,HV
18	Tri	2,2',5-	37680-65-2	Y	Y,S	Y	Y,R	Y,HV
19	Tri	2,2',6-	38444-73-4	Y	Y	Y		Y
20	Tri	2,3,3'-	38444-84-7			Y+		
21*	Tri	2,3,4-	55702-46-0	Y[1]	Y[2],S		Y,R	
22	Tri	2,3,4'-	38444-85-8	Y	Y,S	Y	Y,R	Y,H
23*	Tri	2,3,5-	55720-44-0					
24	Tri	2,3,6-	55702-45-9	Y[1]	Y[2]	Y+		Y
25	Tri	2,3',4-	55712-37-3	Y	Y	Y		Y
26	Tri	2,3',5-	38444-81-4	Y	Y	Y		Y
27	Tri	2,3',6-	38444-76-7	Y[1]	Y[2]	Y+		Y
28	Tri	2,4,4'-	7012-37-5	Y	Y,S	Y+	Y+,R	Y,H
29	Tri	2,4,5-	15862-07-4	Y	Y	Y+		Y
30*	Tri	2,4,6-	35693-92-6	Y	Y[a]	Int Std		Int Std

TABLE D-6. PCB CONGENERS

BZ NUMBER	TYPE	CONGENER	CAS NUMBER	MULLIN STD. (1989)	MSC (A)	NLET (P)	OME	IU
31	Tri	2,4',5-	16606-02-3	Y	Y,S	Y+,R	Y+,R	Y,H
32	tri	2,4',6-	38444-77-8	Y[1]	Y[2],S	Y+		Y
33	tri	2',3,4-	38444-86-9	Y[1]	Y[2],S	Y+	Y,R	Y,H
34	tri	2',3,5-	37680-68-5					
35	tri	3,3',4-	37680-69-6					
36*	tri	3,3',5-	38444-87-0					
37□	tri	3,4,4'-	38444-90-5	Y[1]	Y[2],S		Y,R	Y,H
38*	tri	3,4,5-	53555-66-1					
39*	tri	3,4',5-	38444-88-1					
40	tetra	2,2',3,3'-	38444-93-8	Y	Y	Y,R		Y
41	tetra	2,2',3,4-	52663-59-9	Y[1]	Y[2],S	Y+	Y,R	Y,H
42	tetra	2,2',3,4'-	36559-22-5	Y[1]	Y[2],S	Y+	Y,R	Y,H
43*	tetra	2,2',3,5-	70362-46-8	Y[1]	Y[2],S	Y		Y,H
44	tetra	2,2',3,5'-	41464-39-5	Y	Y,S	Y,R	Y,R	Y,H
45	tetra	2,2',3,6-	70362-45-7	Y	Y	Y		Y
46	tetra	2,2',3,6'-	41464-47-5	Y	Y	Y		Y
47	tetra	2,2',4,4'-	2437-79-8	Y[1]	Y[2],S	Y+	Y+,R	Y,H
48	tetra	2,2',4,5-	70362-47-9	Y[1]	Y[2],S	Y+		Y,H
49	tetra	2,2',4,5'-	41464-40-8	Y[1]	Y[2],S	Y,R	Y,R	Y,H
50*	tetra	2,2',4,6-	62796-65-0			Y		
51	tetra	2,2',4,6'-	68194-04-7	Y	Y	Y		Y
52	tetra	2,2',5,5'-	35693-99-3	Y	Y,S	Y,R	Y,R	Y,H
53	tetra	2,2',5,6'-	41464-41-9	Y[1]	Y[2],S	Y+	Y,R	Y,H
54*	tetra	2,2',6,6'-	15968-05-5			Y+		
55*	tetra	2,3,3',4-	74338-24-2			Y+		
56	tetra	2,3,3',4'-	41464-43-1	Y[1]	Y[2],S	Y+	Y+,R	Y,H+
57*	tetra	2,3,3',5-	41464-49-7					
58*	tetra	2,3,3',5'-	70424-67-8					
59	tetra	2,3,3',6-	74472-33-6			Y+		
60	tetra	2,3,4,4'-	33025-41-1	Y[1]	Y[2],S	Y+,R		Y,H+
61*	tetra	2,3,4,5-	33284-53-6		Y			

TABLE D-6. PCB CONGENERS

BZ NUMBER	TYPE	CONGENER	CAS NUMBER	MULLIN STD. (1989)	MSC (A)	NLET (P)	OME	IU
62*	tetra	2,3,4,6-	54230-22-7					
63	tetra	2,3,4',5-	74472-34-7	Y	Y	Y		Y
64	tetra	2,3,4',6-	52663-58-8	Y[1]	Y[2],S	Y+		Y,H
65*	tetra	2,3,5,6-	33284-54-7					Surr
66	tetra	2,3',4,4'-	32598-10-0	Y[1]	Y[2],S	Y+	Y,R	Y
67	tetra	2,3',4,5-	73575-53-8					
68*	tetra	2,3',4,5'-	73575-52-7					
69	tetra	2,3',4,6-	60233-24-1					
70	tetra	2,3',4',5-	32598-11-1	Y	Y,S	Y+	Y,R	Y,H+
71*	tetra	2,3',4',6-	41464-46-4	Y[1]	Y,S	Y+		Y,H
72*	tetra	2,3',5,5'-	41464-42-0					
73*	tetra	2,3',5',6-	74338-23-1					
74	tetra	2,4,4',5-	32690-93-0	Y	Y,S	Y	Y+,R	Y
75	tetra	2,4,4',6-	32598-12-2		Y[2]			
76*	tetra	2',3,4,5-	70362-48-0		Y,S	Y+	Y,R	Y,H+
77□	tetra	3,3',4,4'-	32598-13-3	Y[1]	Y[2],S		Y,R	Y
78*	tetra	3,3',4,5-	70362-49-1					
79*	tetra	3,3',4,5'-	41464-48-6					
80*	tetra	3,3',5,5'-	33284-52-5					
81*□	tetra	3,4,4',5-	70362-50-4	Y[1]	Y[2],S	Y+	Y,R	Y
82	penta	2,2',3,3',4-	52663-62-4	Y[1]	Y[2]	Y		Y
83	penta	2,2',3,3',5-	60145-20-2	Y	Y	Y		Y
84	penta	2,2',3,3',6-	52663-60-2	Y[1]	Y[2],S	Y	Y,R	Y,H+
85	penta	2,2',3,4,4'-	65510-45-4	Y	Y	Y		Y
86*	penta	2,2',3,4,5-	55312-69-1					
87	penta	2,2',3,4,5'-	38380-02-8	Y[1]	Y[2],S	Y+,R	Y,R	Y
88	penta	2,2',3,4,6-	55215-17-3					
89*	penta	2,2',3,4,6'-	73575-57-2	Y[1]	Y	Y		Y
90	penta	2,2',3,4',5-	68194-07-0					
91	penta	2,2',3,4',6-	68194-05-8	Y	Y	Y+		Y
92	penta	2,2',3,5,5'-	52663-61-3	Y[1]	Y[2],S	Y	Y,R	Y,H+
93*	penta	2,2',3,5,6-	73575-56-1					

TABLE D-6. PCB CONGENERS

BZ NUMBER	TYPE	CONGENER	CAS NUMBER	MULLIN STD. (1989)	MSC (A)	NLET (P)	OME	IU
94*	penta	2,2',3,5,6'-	73575-55-0					
95	penta	2,2',3,5',6-	38379-99-6	Y[1]	Y[2],S	Y+	Y,R	Y,H
96	penta	2,2',3,6,6'-	73575-54-9					
97	penta	2,2',3',4,5-	41464-51-1	Y	Y	Y	Y,R	Y
98*	penta	2,2',3',4,6-	60233-25-2			Y+		
99	penta	2,2',4,4',5-	38380-01-7	Y	Y,S	Y	Y,R	Y
100	penta	2,2',4,4',6-	39485-83-1	Y	Y	Y		Y
101	penta	2,2',4,5,5'-	37680-73-2	Y[1]	Y[2],S	Y,R	Y,R	Y,H
102*	penta	2,2',4,5,6'-	68194-06-9					
103*	penta	2,2',4,5',6-	60145-21-3					
104*	penta	2,2',4,6,6'-	56558-16-8					
105	penta	2,3,3',4,4'-	32598-14-4	Y[1]	Y[2],S	Y+,R	Y,R	Y,H+
106*	penta	2,3,3',4,5-	70424-69-0					
107	penta	2,3,3',4',5-	70424-68-9	Y[1]	Y[2]	Y		
108*	penta	2,3,3',4,5'-	70362-41-3					
109*	penta	2,3,3',4,6-	74472-35-8					
110	penta	2,3,3',4',6-	38380-03-9	Y[1]	Y[2],S	Y	Y,R	Y,H
111*	penta	2,3,3',5,5'-	39635-32-0					
112*	penta	2,3,3',5,6-	74472-36-9					
113*	penta	2,3,3',5',6-	68194-10-5					
114	penta	2,3,4,4',5-	74472-37-0	Y	Y	Y	Y,R	Y+
115	penta	2,3,4,4',6-	74472-38-1					
116*	penta	2,3,4,5,6-	18259-05-7					
117*	penta	2,3,4',5,6-	68194-11-6					
118	penta	2,3',4,4',5-	31508-00-6	Y	Y,S	Y,R	Y,R	Y
119	penta	2,3',4,4',6-	56558-17-9	Y	Y,S	Y	Y,R	Y
120*	penta	2,3',4,5,5'-	68194-12-7					
121*	penta	2,3',4,5',6-	56558-18-0					
122	penta	2',3,3',4,5-	76842-07-4					
123	penta	2',3,4,4',5-	65510-44-3		Y[2]			Y+
124*	penta	2',3,4,5,5'-	70424-70-3	Y[1]	Y[2]			
125*	penta	2',3,4,5,6'-	74472-39-2					

TABLE D-6. PCB CONGENERS

BZ NUMBER	TYPE	CONGENER	CAS NUMBER	MULLIN STD. (1989)	MSC (A)	NLET (P)	OME	IU
126□	penta	3,3',4,4',5-	57465-28-8		Y		Y,R	
127*	penta	3,3',4,5,5'-	39635-33-1					
128	hexa	2,2',3,3',4,4'-	38380-07-3	Y[1]	Y[2]	Y		Y
129	hexa	2,2',3,3',4,5-	55215-18-4	Y[1]	Y[2]	Y		Y
130	hexa	2,2',3,3',4,5'-	52663-66-8	Y[1]	Y[2]	Y		Y
131	hexa	2,2',3,3',4,6-	61798-70-7	Y	Y	Y		Y+
132	hexa	2,2',3,3',4,6'-	38380-05-1	Y[1]	Y[2],S	Y+	Y+,R	Y,H+
133*	hexa	2,2',3,3',5,5'-	35694-04-3			Y		
134	hexa	2,2',3,3',5,6-	52704-70-8	Y	Y	Y+		Y
135	hexa	2,2',3,3',5,6'-	52744-13-5	Y[1]	Y[2]	Y+		
136	hexa	2,2',3,3',6,6'-	38411-22-2	Y	Y	Y	Y,R	Y
137	hexa	2,2',3,4,4',5-	35694-06-5	Y[1]	Y	Y		Y+
138	hexa	2,2',3,4,4',5'-	35065-28-2	Y[1]	Y[2],S	Y+	Y+,R	Y,H+
139*	hexa	2,2',3,4,4',6-	56030-56-9					
140*	hexa	2,2',3,4,4',6'-	59291-64-4					
141	hexa	2,2',3,4,5,5'-	52712-04-6	Y	Y	Y+		Y
142*	hexa	2,2',3,4,5,6-	41411-61-4					
143*	hexa	2,2',3,4,5,6'-	68194-15-0					
144*	hexa	2,2',3,4,5',6-	68194-14-9	Y[1]	Y[2]	Y+		Y+
145*	hexa	2,2',3,4,6,6'-	74472-40-5					
146	hexa	2,2',3,4',5,5'-	51908-16-8	Y		Y		Y
147*	hexa	2,2',3,4',5,6-	68194-13-8	Y[1]	Y[2]	Y		
148*	hexa	2,2',3,4',5,6'-	74472-41-6					
149	hexa	2,2',3,4',5',6-	38380-04-0	Y	Y[2],S	Y	Y,R	Y+
150	hexa	2,2',3,4',6,6'-	68194-08-1					
151	hexa	2,2',3,5,5',6-	52663-63-5	Y[1]	Y[2]	Y		Y
152*	hexa	2,2',3,5,6,6'-	68194-09-2					
153	hexa	2,2',4,4',5,5'-	35065-27-1	Y	Y,S	Y,R	Y+,R	Y+
154*	hexa	2,2',4,4',6,6'-	60145-22-4					
155*	hexa	2,2',4,4',6,6'-	33979-03-2		Y			
156	hexa	2,3,3',4,4',5-	38380-08-4	Y[1]	Y[2]	Y+	Y,R	Y
157	hexa	2,3,3',4,4',5'-	69782-90-7	Y[1]	Y[2]	Y+		Y+

TABLE D-6. PCB CONGENERS

BZ NUMBER	TYPE	CONGENER	CAS NUMBER	MULLIN STD. (1989)	MSC (A)	NLET (P)	OME	IU
158	hexa	2,3,3',4,4',6-	74472-42-7	Y	Y	Y		Y
159*	hexa	2,3,3',4,5,5'-	39635-35-3					
160	hexa	2,3,3',4,5,6-	41411-62-5					
161*	hexa	2,3,3',4,5',6-	74472-43-8					
162*	hexa	2,3,3',4',5,5'-	39635-34-2					
163*	hexa	2,3,3',4',5,6-	74472-44-9	Y[1]	Y[2],S	Y+		Y,H+
164*	hexa	2,3,3',4',5',6-	74472-45-0					
165*	hexa	2,3,3',5,5',6-	74472-46-1					
166*	hexa	2,3,4,4',5,6-	41411-63-6		Y			Surr
167	hexa	2,3',4,4',5,5'-	52663-72-6	Y[1]	Y[2]	Y		Y
168*	hexa	2,3',4,4',5',6-	59291-65-5					
169□	hexa	3,3',4,4',5,5'-	32774-16-6	Y	Y	Y	Y,R	
170	hepta	2,2',3,3',4,4',5-	35065-30-6	Y[1]	Y	Y+		Y+
171	hepta	2,2',3,3',4,5,6-	52663-71-5	Y[1]	Y[2]	Y+		Y+
172	hepta	2,2',3,3',4,5,5'-	52663-74-8	Y	Y	Y		Y
173	hepta				2,2',3,3',4,5,	68194-16-1	Y[1]	Y
174	hepta	2,2',3,3',4,5,6'-	38411-25-5	Y	Y	Y		Y
175	hepta	2,2',3,3',4,5',6-	40186-70-7	Y		Y		Y
176	hepta	2,2',3,3',4,6,6'-	52663-65-7	Y[1]		Y		Y+
177	hepta	2,2',3,3',4',5,6-	52663-70-4	Y	Y	Y		Y
178	hepta	2,2',3,3',5,5',6-	52663-67-9	Y[1]	Y[2]	Y		Y
179	hepta	2,2',3,3',5,6,6'-	52663-64-6			Y+		
180	hepta	2,2',3,4,4',5,5'-	35065-29-3	Y	Y	Y+,R	Y,R	Y
181*	hepta	2,2',3,4,4',5,6-	74472-47-2					
182*	hepta	2,2',3,4,4',5,6-	60145-23-5	Y[1]	Y[2]	Y+		Y+
183	hepta	2,2',3,4,4',5',6'-	52663-69-1	Y	Y	Y		Y
184*	hepta	2,2',3,4,4',6,6'-	74472-48-3					
185	hepta	2,2',3,4,5,5',6-	52712-05-7	Y	Y	Y		Y
186*	hepta	2,2',3,4,5,6,6'-	74472-49-4					
187	hepta	2,2',3,4',5,5',6-	52663-68-0	Y[1]	Y[2]	Y+		Y+
188*	hepta	2,2',3,4',5,6,6'-	74487-85-7					
189	hepta	2,3,3',4,4',5,5'-	39635-31-9	Y	Y	Y		

TABLE D-6. PCB CONGENERS

BZ NUMBER	TYPE	CONGENER	CAS NUMBER	MULLIN STD. (1989)	MSC (A)	NLET (P)	OME	IU
190	hepta	2,3,3',4,4',5,6-	41411-64-7	Y[1]	Y	Y+		Y+
191	hepta	2,3,3',4,4',5',6-	74472-50-7	Y	Y	Y	Y,R	Y
192*	hepta	2,3,3',4,5,5',6-	74472-51-8					
193	hepta	2,3,3',4',5,5',6-	69782-91-8	Y	Y	Y		Y
194	octa	2,2',3,3',4,4',5,5'-	35694-08-7	Y	Y	Y	Y,R	Y
195	octa	2,2',3,3',4,4',5,6-	52663-78-2	Y[1]	Y	Y+	Y,R	Y+
196	octa	2,2',3,3',4,4',5,6'-	42740-50-1	Y[1]	Y[2]	Y+		Y
197	octa	2,2',3,3',4,4',6,6'-	33091-17-7	Y				Y
198	octa	2,2',3,3',4,5,5',6-	68194-17-2	Y	Y	Y		Y
199	octa	2,2',3,3',4,5,6,6'-	52663-73-7	Y[1]	Y[2]	Y+		Y+
200	octa	2,2',3,3',4,5',6,6'-	40186-71-8	Y	Y	Y		Y
201	octa	2,2',3,3',4,5,5',6'-	52663-75-9	Y	Y	Y		Y
202	octa	2,2',3,3',5,5',6,6'-	2136-99-4	Y[1]	Y	Y+		Y+
203	octa	2,2',3,4,4',5,5',6-	52663-76-0	Y[1]	Y[2]	Y+		Y
204*	octa	2,2',3,4,4',5,6,6'-	74472-52-9	Y	Y[a]	Int Std		Int Std
205	octa	2,3,3',4,4',5,5',6-	74472-53-0	Y	Y	Y	Y,R	Y
206	nona	2,2',3,3',4,4',5,5',6-	40186-72-9	Y	Y	Y+	Y,R	Y
207	nona	2,2',3,3',4,4',5,6,6'-	52663-79-3	Y	Y	Y		Y
208	nona	2,2',3,3',4,5,5',6,6'-	52663-77-1	Y[1]	Y	Y		
209	deca	2,2',3,3',4,4',5,5',6,6'	2051-24-3	Y	Y	Y		Y

NOTES: An ***** and **bold** are used to denote the 77 PCB congeners that do not exist in commercial mixtures.
An □ indicates a coplanar PCB.
An (A) indicates that the laboratory only analyzes air samples.
A (P) indicates that the laboratory only analyzes precipitation samples.
An "H" indicates a priority based on high concentration and "HV" a priority based on high concentration in the vapor phase.
An "R" indicates a recommended priority based on either high concentration or toxicity.
An "S" indicates a congener to be included in a PCB "suite" which regularly comprises between 90 and 95% of total mass of PCBs in ambient air or has been added because of its toxicity.
A "T" indicates a recommended priority based on toxicity.
A "Y" indicates a congener that is analyzed for or is present.
A "+" indicates a congener that coelutes with another congener.
A "[1]" indicates a congener that coelutes with another congener(s) present in the Mullin Standard on a 30m DB% column (MSC method).
A "[2]" indicates a congener that coelutes with another congener(s) present in the MSC Standard Set on a 60m DB% column (MSC method).
A "[a]" indicates a congener that is now used as a recovery surrogate species.
Int Std: Internal Standard
Surr: Surrogate Standard

Sampling/Analysis Protocols

The details of sampling and analytical protocols are provided in the QAPjPs for each agency. A brief summary is provided in Table D-7. All stations (including all satellite facilities except Egbert) contain samplers to measure wet deposition of gaseous organics and trace metals. The sampler used for the organics measurements is uniform across the network, an MIC-B collector with stainless steel funnel. EPA/Indiana University (and, historically, OME and NWRI) uses XAD-2 resin column cartridges for capturing the organics. EHD uses a dichloromethane solvent extraction system in which the rainwater is bubbled through a 250 ml dichloromethane volume. EHD samples on a 14-day cumulative basis, EPA/IU (and, historically, OME and NWRI) takes a 28-day cumulative sample. Trace metals in precipitation measurements are only conducted by EHD.

Organics air sampling is made using high volume samplers with filter and absorbant combinations. EPA/Indiana University (and, historically OME) uses a hi-vol which has an XAD-2 absorbant cartridge. This allows gathering >2000 m^3 of sample volume. MSC uses polyurethane foam as the absorbant for organics. Sample volumes are kept below 400 m^2 to avoid breakthrough of lighter organics during warm summer months. Early results showed that little organochlorine mass was found on the filter and, for the U.S. laboratories this required compositing filters in order to get sufficient sample for analysis. Thus, the PAH analysis in the U.S. lost some time resolution in order to gain resolution for the organochlorines. In Canada, MSC dropped the particulate organochlorine analysis after 1991 and retained the high time resolution (1 day in 6 up to 1994 and 1 day in 12 thereafter) for the PAHs in order to better determine potential source information.

Laboratory analysis protocols generally call for solvent extraction of the organic sampling media, nitrogen blowdown to small volume (typically 1µl) and injection on GC-ECD or GC-MS. Details of these analyses can be found in the Laboratory Protocol Manuals or the agency project plans (QAPjPs).

Table D-7: Summary of sampling and analysis methods

MEDIA/ PARAMETER	AGENCY	SAMPLING METHOD[A]	SAMPLING FREQUENCY[B]	ANALYTICAL METHOD	REPORTING UNITS
Air Organics (PCBs, Pesticides, PAHs)	MSC	Hivol PUF Sampler: GFF + PUF	24 hr/12 days	Soxhlet/GC-ECD (PCBs, Pesticides); HPLC-fluorescence (PAHs)	pg/m^3
	MOE	Hivol: GFF + XAD2	24 hr/12 days	Soxhlet/GC-ECD or GC/MS	ng/m^3
	Indiana U	Hivol: GFF + XAD2	24 hr/12 days	Soxhlet/GC-ECD (PCBs, Pesticides); GC/MS (PAHs)	pg/m^3
Air Metals	MSC	PM10/15 HiVol	24 hr/12 days	ICP-MS or INAA	ng/m^3
	MOE[d]	LoVol	28 days	ICP	ug/m^3
	EPA[e]	PM10 Dichot	96 hr/28 days	XRF	ng/m^3
Precipitation Organics (PCBs, Pesticides, PAHs)	NWRI	MIC-B/XAD2	28 days	GC-ECD	ng/L
	EHD	MIC-B/DCM	14 days	GC-ECD or GC-ECD-MS	ng/L
	MOE	MIC-B/XAD2 + GFF	28 days	GC-MS	ng/L
	Indiana U	MIC-B/XAD2	28 days	GC-ECD	ng/L
Precipitation Metals	NWRI	MIC-AU	28 days	ICP, AAS	ug/L
	EHD	MIC-A	monthly	AAS	ug/L
	MOE	MIC-A	28 days	ICP-MS	ug/L
Related Air Measurements					
Total Organic Carbon	MSC	HiVol/GFF	24 hr/6 days	Thermal Desorption	ug/m^3
Total Suspended Part.	MSC, Indiana U	HiVol/GFF	24 hr/6 days	Gravimetric	ug/m^3
PM10	Indiana U	Dichot/TF	96 hr/mo.	Gravimetric	ug/m^3
Meteorology[c]					
Temperature	MSC, Indiana U, MOE	Thermistor	hrly. avg.	Direct Reading	°C
Relative Humidity	MSC, Indiana U, MOE	Hygristor	hrly. avg.	Direct Reading	Percent
Barometric Pressure	Indiana U		hrly. avg.	Direct Reading	kPa
Wind Speed	MSC, Indiana U, MOE	Anemometer	hrly. avg.	Direct Reading	m/s
Wind Direction	MSC, Indiana U, MOE	Vane	hrly. avg.	Direct Reading	Degrees
Precipitation Amount	MSC, MOE	Type B Rain Gauge	24 hrs	Direct Reading	mm
	Indiana U, MSC	Belfort gauge	continuous	Direct Reading	mm
Solar Irradiation	MSC, MOE	Pyranometer	hrly. avg.	Direct Reading	w/m^2
	Indiana U	Pyranometer	hrly. avg.	Direct Reading	Langleys

NOTES:

[a] Sampling and analysis methods used by different groups may appear similar, but differ significantly in operational and other details.

[b] Sampling frequency is sometimes given as sample duration/sampling interval.

[c] MOE operated meteorological equipment at their Dorset station only.

[d] MOE no longer collects samples as of 2000

[e] USEPA / IU discontinued analysis in 1994, sampling in 2000

KEY TO ABBREVIATIONS

AAS	atomic absorption spectroscopy
DCM	dichloromethane solvent
Dichot	dichotomous sampler
ECD	electron capture detector
GC	gas chromatography
GFF	glass fibre filter
HiVol	high volume sampler
ICP	inductively coupled plasma spectrometry
INAA	instrumental neutron activation analysis
LoVol	low volume sampler
MIC-A	MIC type A precipitation sampler
MIC-AU	MIC type AU precipitation sampler
MIC-B	MIC type B precipitation sampler
MS	mass spectrometry
PM10	particulate matter less than 10μm in diameter
PUF	polyurethane foam plug
XAD2	XAD-2 resin
XRF	x-ray fluorescence

APPENDIX E - MEMBERSHIP OF IADN

This Appendix contains the current membership roll of the active members of the IADN program, with their correct addresses and phone/FAX numbers followed by their organization charts. The list and charts will be updated annually.

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IADN QAM	

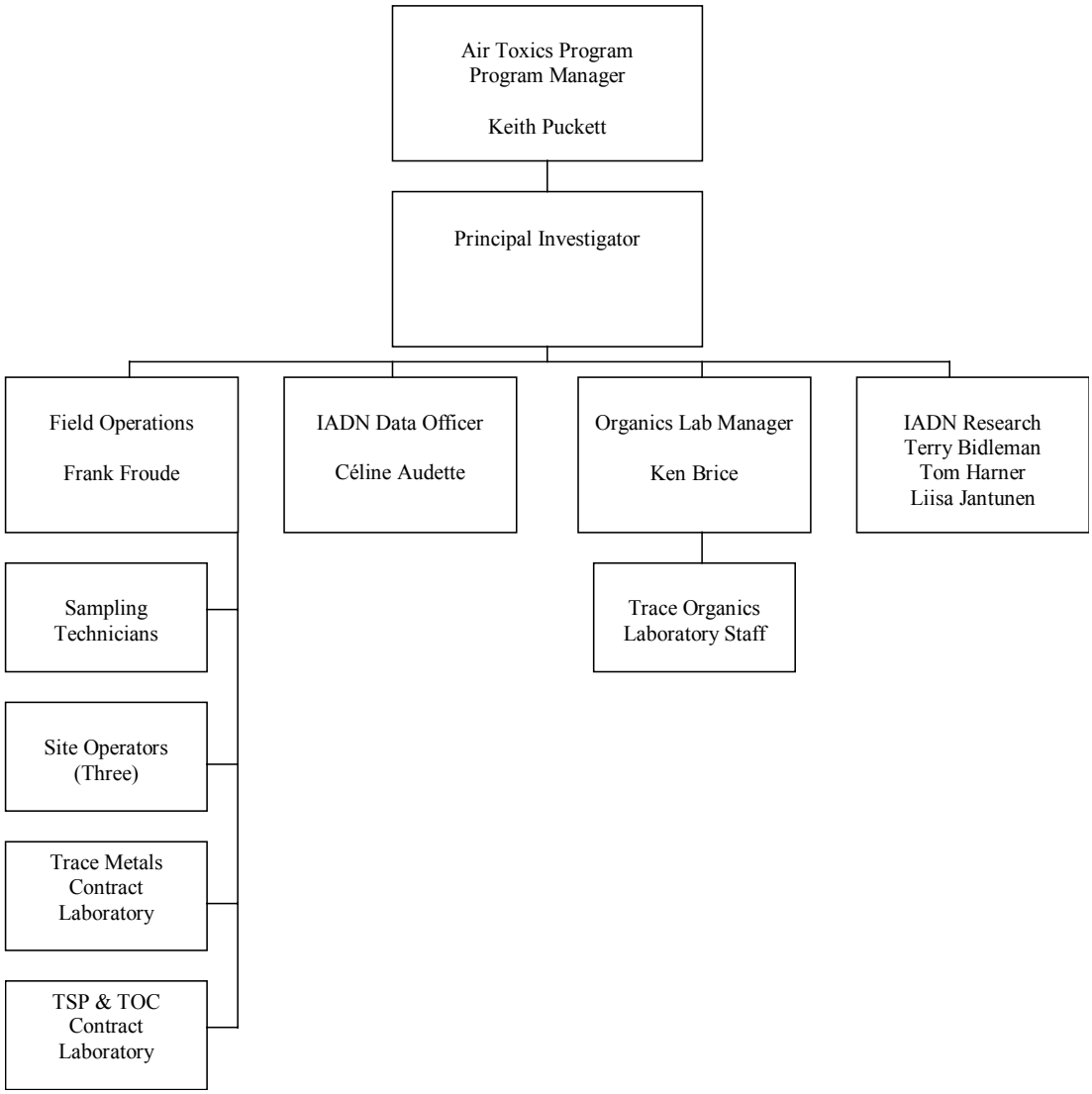

Figure E-1. Organization of MSC for IADN

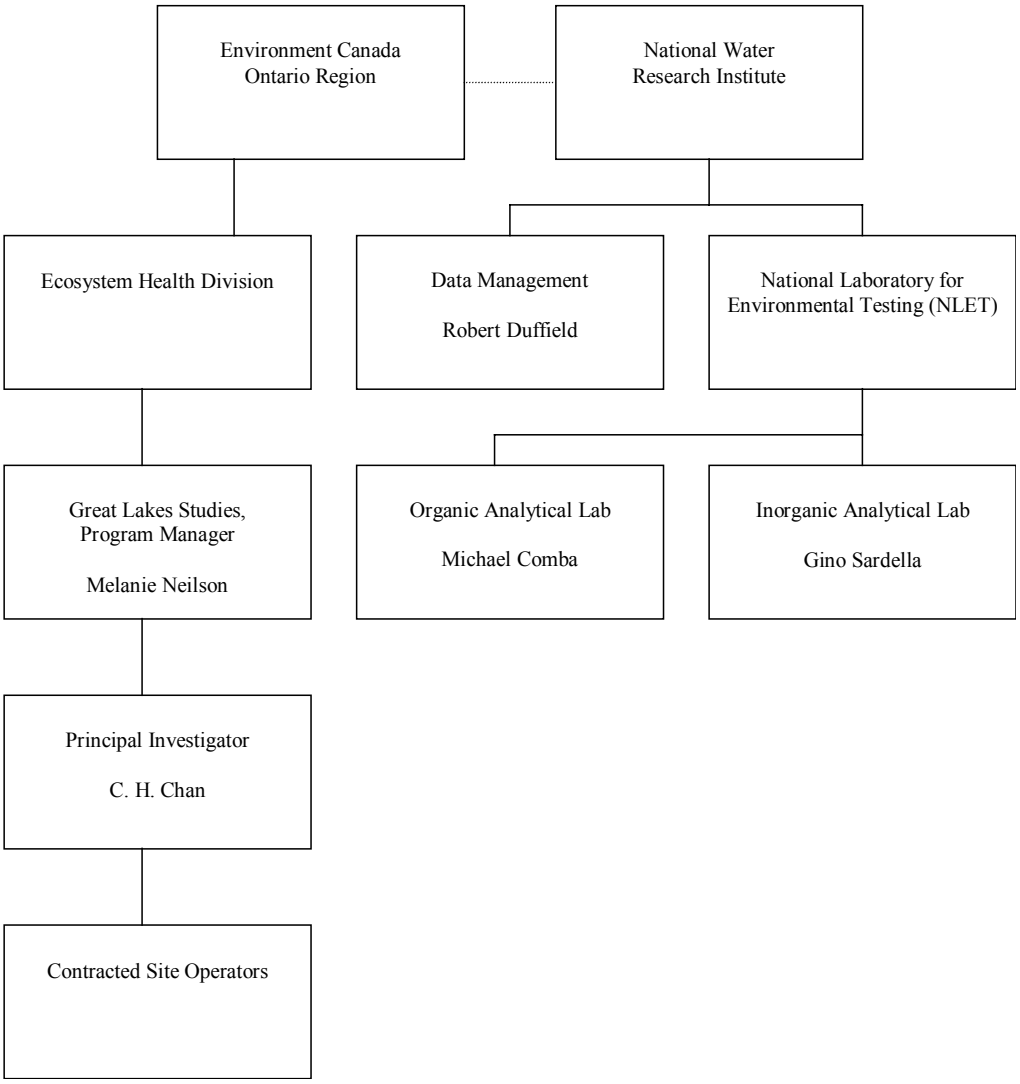

Figure E-2. Organization of EHD and NWRI for IADN

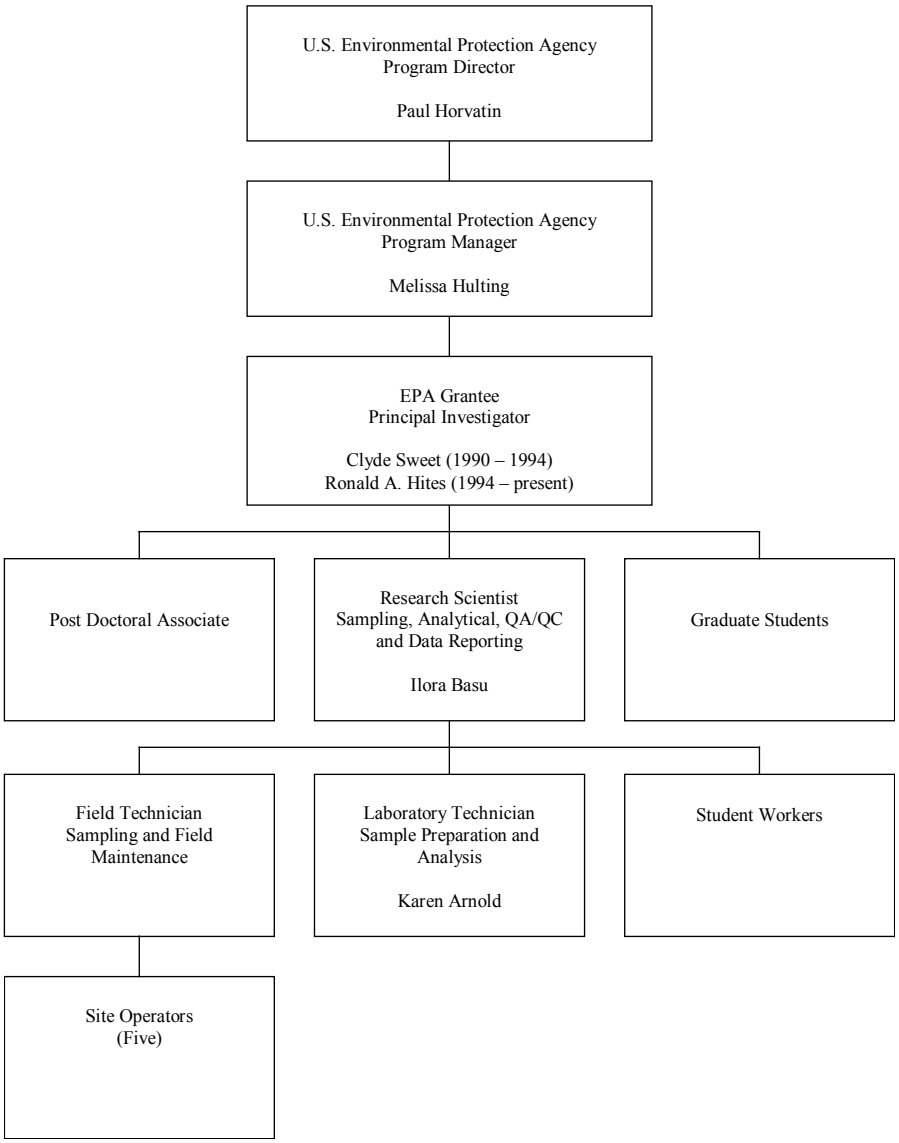

Figure E-3. Organization of USEPA and IU for IADN

APPENDIX F - GUIDELINES FOR CONTENTS OF QUALITY ASSURANCE PROJECT PLANS

GUIDELINES FOR CONTENTS OF QUALITY ASSURANCE PROJECT PLANS

Section 4.2 of this QAPP lists the required elements of QAPjPs for IADN participants. This Appendix contains discussions of each of these elements. There are several groups participating in the IADN program, and each has its own QAPjP (or equivalent). Because this QAPP is the only program-wide QA document for the IADN, it is necessary to include a certain level of detail on the following subjects in order to promote consistency of QAPjPs and operational methods among IADN participants. Where applicable material is included in the body of this QAPP, it has been referenced. In other cases, additional detail on QA requirements has been included within this Appendix.

Project Description

This section of a QAPjP should be a brief description of the overall project, especially the monitoring activities covered by the QAPjP, including the type of samplers to be used, the approximate number of monitoring stations, and the goals of the project. See Section 1.3 of this QAPP for a description of the IADN as a whole.

Project Organization and Responsibility

This section should contain a brief outline of the responsibilities of any personnel not included in the QAPP, and a chart of the project organization. Section 3.1 of this QAPP contains an organizational chart for the IADN showing the participating agencies and their relationships to one another. Appendix D contains organizational charts for the individual agencies that perform data collection as a part of the IADN. Section 3.2 describes the responsibilities of these agencies with respect to the IADN and Annex 15 of the GLWQA, and Section 3.3 describes the organization and responsibilities of the Steering Committee that leads the IADN. Section 3.4 details the responsibilities of specific IADN personnel.

Sampling Procedures and Siting Criteria

This section must include or reference detailed SOPs for field sampling operations and the criteria that are used to choose sites for monitoring stations. Detailed descriptions of each site should be included, with latitudes and longitudes, and a location map for each site. Appendix C of this QAPP contains the IADN siting criteria. Section 4.3 of this QAPP addresses SOP requirements for IADN participants.

Sample Custody

This section will describe the methods used to keep a record of all the steps of a sample's progress, including collection, labeling, handling, transport, and laboratory analysis. The section should also include copies of all sample tracking forms, etc.

Sample Tracking Procedures - Formal chain-of-custody procedures are not a requirement. However, a unique sample i.d. shall be assigned at collection, and this i.d. must be carried through to data tabulation. A record must be kept of all the steps of a sample's progress through the system, including collection, labeling, handling, transport, and laboratory analysis. The sample tracking codes are to be included in the database in a manner which facilitates tracking the origin of all data. Copies of all sample tracking forms are to be maintained in each agency's central documentation archive.

Calibration Procedures

This section should describe or reference calibration procedures for all field and laboratory instruments used in the project. Each description should contain specific calibration procedures, including details of calibration standards and traceability, and calibration schedules.

Analytical Procedures

This section should include or reference detailed SOPs for all analytical procedures, including sample preparation and cleanup. If standard materials are available, they may be referenced. Nonstandard methods must be described in detail, either in the QAPjP, or in separate standard operating procedures. Section 4.3 of this QAPP addresses SOP requirements for IADN participants.

Procurement of Materials and Equipment - Care must be taken to ensure that no error is introduced to the data as a result of variability in the quality of materials used in the data collection process. All media used in sampling and analysis (*e.g.*, filters, resins, etc.) shall be of certified quality, with random samples from each lot tested for purity and absence of contaminants prior to their use in the lab or field. The sources of all materials shall be documented, with a record kept of the receipt of each lot and the samples for which it was used. All QA/QC materials (*i.e.*, reference standards) must be certified, and records of their origin and use must be maintained. All instruments or equipment must be tested to ensure proper operation and compliance with specifications prior to use.

Data Reduction, Validation, and Reporting

This section should describe the procedures used to manage the data produced by the project. Details should be provided of the methods and equations used to reduce the raw data to useable form, including treatment of blanks. Data validation procedures should also be described, including detailed lists of all comment codes and validation flags used to annotate data. Data reporting should also be covered, with descriptions of the reporting format and units, and a list of all deliverables required of the analytical laboratory. These topics are discussed in Sections 4.4 and 4.5 of this QAPP.

Internal Quality Control Checks

This section contains descriptions of all QC checks that are used throughout the project, including field and laboratory activities. This should include details of split or replicate samples, spikes, blanks, and any other techniques used to evaluate the analytical methods.

Laboratory Quality Control Checks - Quality control for analytical procedures shall be provided by a regular schedule of laboratory quality control checks. These shall include control checks to quantify the variability of the results in terms of precision and accuracy, and recognize out-of-control conditions as they develop. These QC checks are to be described in detail in the SOPs for each laboratory and shall include the following:

- Regular instrument calibrations
- Analysis of control samples for instrument drift and analytical precision and recovery
- Analysis of QC samples: evaluation of precision, accuracy, and bias by analysis of spiked samples, surrogate recovery, laboratory blanks, and duplicate samples
- Maintenance of QC documentation: control charts, MDL, statistics, and control limits
- Assessment of comparability through interlaboratory comparisons of spiked samples
- Preliminary data validation and screening in order to flag data records from: damaged or contaminated samples, samples with insufficient documentation, samples containing concentrations which exceed expected levels by statistically significant margins, and samples analyzed without proper QC procedures

Any analysis resulting in questionable results shall be repeated, if possible, or flagged if reanalysis is not feasible. If the results of any QC check do not meet the acceptance criteria set in the laboratory SOPs, the analytical results shall be flagged back to the last run for which all QC checks were acceptable.

Field Quality Control Procedures - Quality control procedures for field operations shall be performed on a regular basis. Field QC is to be described in detail in SOPs for field operations or technical/operator manuals. Important field QC procedures include:

- Flow rate calibrations for air samplers
- Calibration of scales used to weigh precipitation samples
- Traceability of all calibration standards to primary reference standards
- Visual checks on meteorological equipment

Performance and System Audits

This section should describe the QA audits to be used to assess the operation of the project. A schedule should be included, along with a description of each type of audit that is planned. Reporting requirements should also be given. IADN auditing requirements are addressed in Section 5.1 of this QAPP, with audit reporting requirements in Section 5.3.1.

Preventive Maintenance

This section should contain a summary of the preventative maintenance procedures to be used for both field and laboratory equipment, including a performance schedule.

Specific Routine Procedures to Assess Data Quality Indicators:
Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC)

This section should contain detailed descriptions of the methods used to calculate and assess data quality indicators. Equations should be included for precision, accuracy, completeness, and method detection limit. This section should complement the section on data quality objectives, providing the means for assessing whether or not data meet the DQOs.

Corrective Action

This section should describe the project corrective action system. This should include the criteria which determine when corrective actions are called for, and procedures by which they are to be implemented. Also included should be a corrective action request/tracking form which will follow the request through the system, until the problem is rectified. Corrective actions are addressed in Sections 4.4.4 and 5.3.2 of this QAPP, for corrective actions resulting from data assessments and from audits, respectively.

QA Reports to Management

This section should describe the type and frequency of QA reports to management that are required. The persons responsible for preparing these reports should also be identified. IADN QA reporting requirements are addressed in Section 5.3.2 of this QAPP.